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13. Abstract ***(Maximum 200 Words)*** *(abstract should contain no proprietary or confidential information)*

The objective of the proposed research is to develop 1H-decoupled 31P magnetic resonance spectroscopy (MRS) techniques for measuring non-invasively the response of breast cancer to induction or preoperative chemotherapy. We hypothesize that the quantitative assessment of the effectiveness of a treatment using 31P MRS will be clinically feasible at 3.0T. To validate our approach, we propose first, to perform measurements using appropriate standards and, second, a pilot study including women with breast cancer undergoing induction chemotherapy. During the first year of funding, a prototype double tuned proton/31-phosphorus transmit-receive coil has been built. The coil has been tested at 3.0T (proton frequency: 123.23 MHZ; 31-phosphorus: 49.89 MHz) by using standards containing compounds of interest (phosphorylethanolamine, inorganic phosphate and 5-adenosine triphosphate).

14. Subject Terms (keywords previously assigned to proposal abstract or terms which apply to this award)

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INTRODUCTION

Advances in the understanding of the biology of breast cancer are leading to the identification of novel therapeutic targets, the development of new cytotoxic agents and strategies for treatment of this disease. The identification of a marker of tumor response to a specific chemotherapeutic agent will make possible to customize an effective treatment for each patient. Phosphorus-31 (31P) MRS can provide information non-invasively on alterations in tumor metabolism caused by chemotherapy in women with breast cancer. Thus, the objective of the proposed research is to develop 1H-decoupled 31P magnetic resonance spectroscopy (MRS) techniques for measuring non-invasively the response of breast cancer to induction or preoperative chemotherapy. To validate our approach, we propose first, to perform measurements using appropriate standards and, second, a pilot study including women with breast cancer undergoing induction chemotherapy.

BODY

During the first year of funding, the approved Statement of Work included in Task 1, the construction and test of rf coils for proton imaging of the breast and detection of 31P at 3.0T, the optimization of the protocols and, in Task 2, the initiation of the in vivo studies. Todate, progress in the proposed research has been slowed by a delay in the delivery of the 3.0T system for thoracic imaging, initially scheduled for October 2000. The system has now been tested at the manufacturer's site (Siemens AG, Erlangen, Germany) and manufacturer's estimate for the delivery date is August 21, 2001. Despite the technical problems, we have accomplished part of the objectives outlined in Task 1. A prototype double tuned proton/31-phosphorus transmit-receive coil has been built. The coil was tested on a 3.0T Allegra (Siemens AG) by using samples with known concentrations of phosphorus metabolites of interest for the proposed research. Specifically, a standard with phosphate buffered solution, pH = 7 (100 cc, 50 mM, potasium monobasic phosphate + sodium hydroxide), having 20 mM of phophorylethanolamine (PE) and 20 mM of 5-adenosine triphosphate (ATP) was prepared.

Proton imaging protocols currently applied to clinical breast imaging at lower fields were used to acquired images at 3.0T (proton frequency: 123.23 MHz). These protocols included proton density, T2-weighted and fast gradient echo imaging. The typical signal-to-noise ratio, SNR, obtained with the standard solution mentioned above was 60.

Figure 1 shows a 31-phosphorus spectrum of the standard solution acquired at a frequency of 49.89 MHz by using a one pulse sequence. The total acquisition time was 17 minutes. The resonances of PE (+3 ppm), inorganic phosphate and γ-ATP (+1 ppm), α-ATP (-9.5 ppm) and β-ATP (-21.5 ppm) are observed. The chemical shifts were externally referred to that of 85% phosphoric acid. Optimization of the hardware and protocols will be performed immediately after installation of the 3.0T whole body scanner at the end of this month. It is anticipated that we will be able to perform *in vivo* 31-phosphorus measurements by the end of 2001.

KEY RESEARCH ACCOMPLISHMENTS

- Construction of double tuned proton/31-phosphorus coil
- Test of coil with standard solutions

REPORTABLE OUTCOMES

No reportable outcomes from this research have resulted yet.

CONCLUSIONS

In summary, we have built and tested the necessary hardware to perform the proposed 31-phophorus measurements. This will allow us to continue with the task outlined in the approved Statement of Work for the next funding period.

REFERENCES

n/a

APPENDICES

n/a

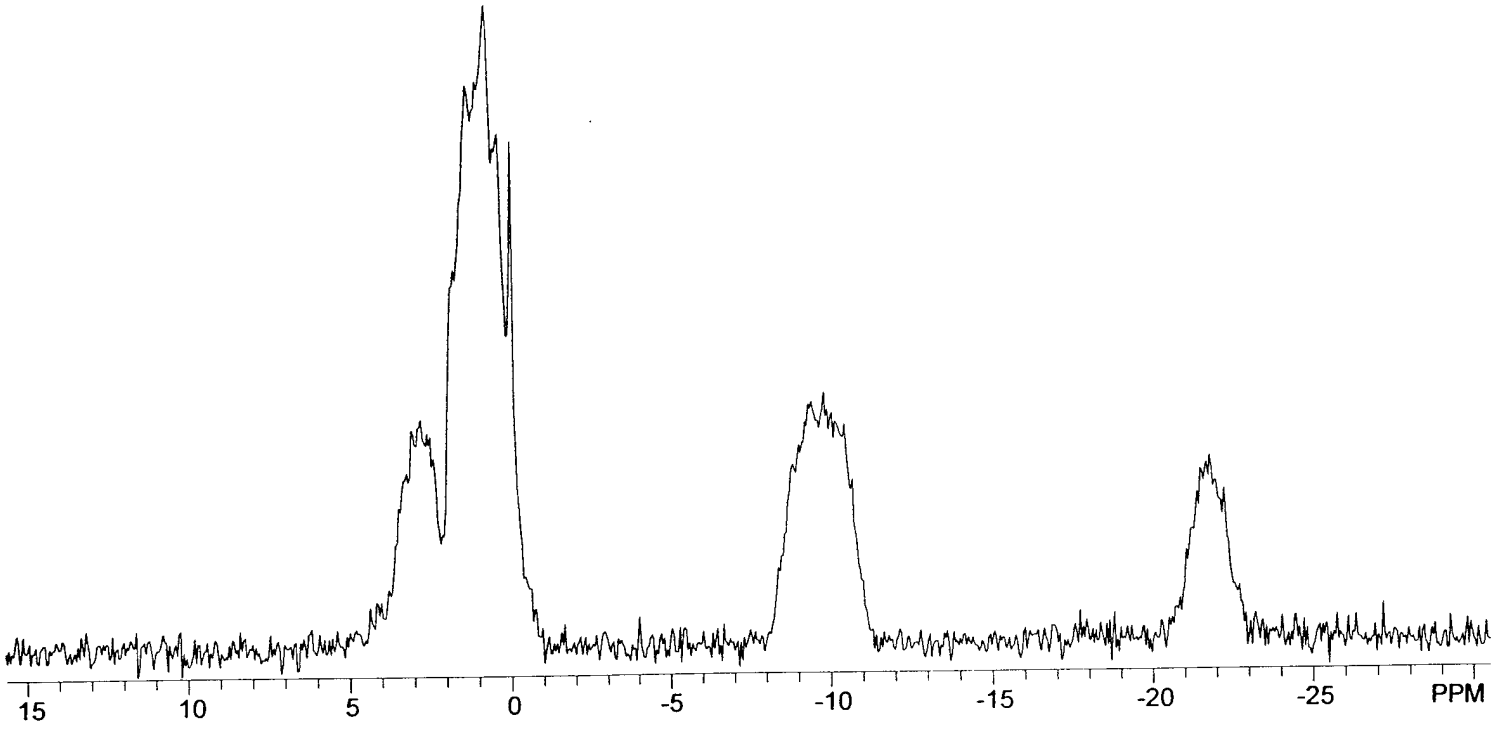

Figure 1. 31-Phosphorus spectrum of a standard solution containing phophorylethanolamine (PE) (chemical shift at +3 ppm); 20 mM, 5-adenosine triphosphate (ATP) 20 mM (chemical shifts at +1, -9.5 and -21.5 ppm) and inorganic phosphate 50 mM (chemical shift at +1 ppm) acquired at 3.0T (31P frequency: 49.89 MHz).